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# ANTISEPTICITY IN SURGERY.

ROYAL COLLEG

ON

# ANTISEPTICITY

IN

# SURGERY.

*[Reprinted from the 'Manchester Medical and Surgical Reports,'* 1871.]

By EDWARD LUND, F.R.C.S.,

LECTURER ON ANATOMY, AND ONE OF THE SURGEONS TO THE MANCHESTER ROYAL INFIRMARY.

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*Cui bono pus?*

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PRESENTED
by the
AUTHOR.

MANCHESTER:
J. E. CORNISH, 33, PICCADILLY.
1872.

“Keep the wound clean.”

*Motto.*

# ON ANTISEPTICITY IN SURGERY,

*Being the text of a paper read before the Surgical Section of the British Medical Association at Plymouth, August 9th,* 1871,

By EDWARD LUND, F.R.C.S.,

LECTURER ON ANATOMY, AND ONE OF THE SURGEONS TO THE MANCHESTER ROYAL INFIRMARY.

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[Those who had the advantage of listening to the able and deeply interesting address in surgery, delivered by Professor Lister at Plymouth, might perchance imagine that the author of this paper had in some instances borrowed his remarks and illustrations on the antiseptic system from the professor's lecture. But, if any coincidences should be observable, they can only illustrate the fact that two independent observers, working at the same subject, and drawing their conclusions from the same sources, have arrived at very nearly similar opinions; for this paper was written some weeks before the meeting at Plymouth, and it was read at the surgical section the day before that on which the address was delivered, without any communication whatever with the learned professor. All that the author can aspire to, in advocating the use of antiseptics in surgery, is that he may be regarded as having been for nearly four years past an humble and earnest labourer in the field of inquiry, as to the theory of the treatment of wounds, which Professor Lister originated; and, as a witness from prolonged experience, that the theory is so correct in principle, that it must ultimately be adopted by all who teach or practise surgery.]

I propose in the following remarks to consider very briefly what is meant by antisepticity in surgery; how far its observance affects the progress of recent wounds, influences the closure of healing wounds, and lastly, how far the principles of antisepticity can be most easily and successfully carried out in practice.

Antisepticity is a term of modern use, although the idea which it conveys is not new. It has always been known, and has long since been acknowledged, that cleanliness in the treatment of wounds is of the first importance; and the old expression "foul and putrefying sores" was always held as the antithesis of "the healing process." The cause why, under any circumstances, the surfaces of wounds exposed to the air should become putrid and exhale a sickly fœtid odour, is due primarily to the fact that from such surfaces, that is to say, from the divided surfaces of any part of the body for some time after their formation, a certain quantity of fluid is always secreted, and this fluid is not only the blood itself, or the serosity of blood after partial coagulation, but the colourless serum escaping from divided capillaries and minute vessels, too small to permit the transit of the red globules. This fluid matter, together with other secretions from such surfaces, might be styled the *excreta* of wounds, as serving no useful purpose in the animal economy, and as being waste unused material thrown off from the body. Resting therefore on the surface of these parts in free contact with the atmosphere, and influenced by "something in the air" which determines putrefaction, these fluid excretions undergo putrefactive change with a degree of rapidity due to several distinct causes. First, as to the attendant or external causes, the presence of water is one of the most important, for whenever this is in excess and stagnant, putrefaction will surely advance most quickly; where little moisture is present, or where that which is exuded from the surface is dried up or accidentally removed, the changes by putridity are less easily excited. In special states of the system, such as in times of great nervous depression, when the vital powers of the whole body are diminished, we see many of the secretions altered in character, as is evidenced in the *sordes* on the teeth and lips in fevers and other exhaustive diseases; and in the serous exudation from the surface of ulcerating malignant growths which quickly putrefies, from its heterologous nature originating in a low vitality and possessing a feebly resisting power to chemical change. Even in wounds on the feet and on distant parts of the body it will be observed that the excretions become much more rapidly putrid than on parts nearer to the centre of the circulation, and this can be explained only by assuming that with less vital power there is less resistance to chemical action. It should therefore be our effort, at all times, to avert changes which in their nature indicate a low degree of vitality rather than a high one; and all the means which have been employed from time to time to secure this result seem to have had the same object in view. The most simple method practised, and that which would occur to any one at first as the most appropriate, is the removal as soon as formed of the excretions resting on the wound. This can be effected only by the frequent cleansing of the surfaces, as in the irrigation of wounds by cold water when this one condition seems to be attained; for, although it may be said that where water irrigation has been used very little, pus or the products of inflammation are observable, because they are washed away in the stream of liquid, yet it has been shown that even making every allowance for this and the reduction of the temperature of the part by the same means, from the very fact of the surface being kept absolutely clean and its *excreta* instantly removed, inflammatory changes never advance to the suppurative stage in these cases to the same degree as when these precautions have not been taken. Whatever means we adopt to prevent the putrefactive changes on the surface of a wound, it is of the greatest importance that they should be commenced early, for as soon as one portion of the excreta has undergone putrefaction, the changes thus induced seem to set up in all succeeding portions a similar tendency to putrefaction. There is, as it were, a system of auto-inoculation started with corresponding poisoning of the system which is perpetuated from hour to hour as the excreta are thrown off. The time, therefore, at which real benefit is to be chiefly attained in the treatment of wounds upon antiseptic principles is in their earliest stages; as soon as the surface of the body has become abraded and the deeper tissues laid bare, that instant the earliest stages of chemical change begin and our efforts to avert them must be commenced; or if this cannot be done we must remove the products of putrefaction without delay. This, then, is the fundamental principle of what may be called the adaptation of antiseptics to the treatment of wounds, solely and simply to avert chemical putrefactive change in the excreta which they form. The larger the wound the greater the amount of the excretion. In small wounds many circumstances combine to protect them from these changes, and hence it is that such wounds as those produced in amputations, the removal of deeply seated tumours and the like, are far more disposed to take on what is called "bad action" than simple incised wounds of lesser extent, or a collection of smaller wounds which might in the aggregate invade a surface equal in area to the larger wound. Those who would be disinclined to think that to follow out the principles of antisepticity is of little value in the treatment of wounds, because perchance wounds treated almost any how occasionally do well, should analyse very carefully the conditions under which wounds are pretty certain to advance favorably, aad contrast them with those in which the opposite result is sure to follow. We know very well that if in the management of a large wound, soon after an operation or an accident, the atmospheric air is allowed free access and the blood effused on the surface is not removed, but allowed to remain moist by wet cloths placed over the surfaces (which themselves will furnish one chief element of putrefaction), or if, in the dressing of such a wound, sponges be used which are not properly rinsed, or cloths which are not quite clean, these are the circumstances under which a wound will fail to do well, and in which we can certainly predicate an unfavorable issue. On the other hand, if little time is allowed to elapse between the receipt of the injury and the first dressings, if the surface is merely covered over by a layer of fluid blood, if the edges of the wound are placed in contact and the blood not too much removed, but allowed to cake and dry along the margins of the wound, and if, fortunately, no further hæmorrhage occur, the most simple dressing, such as a piece of lint wetted in water, allowed to dry on, or lint dipped in oil, to cover the part and to exclude the air, will suffice, in a large proportion of cases, to secure a favorable termination. Excessive loss of tissue will be prevented, the reparative changes will pass on unmolested, and a perfect union of the surfaces will be accomplished. But these are conditions which we must all admit are the exception rather than the rule, and so it becomes an interesting point to consider, besides the more evident results of simple cleanliness in the treatment of wounds, what are the influences which a strict observance of antiseptic principles has upon recent wounds, and also its effects upon healing wounds. In recent wounds our great effort is to close in the injured surface and to convert the open into a closed wound. All our plasters and older dressings had this object, and were successfully employed upon this principle, yet they failed constantly, or were apt to do so, on account of changes which originated in the deeper recesses of the wound when all on the surface seemed to be doing well. In many cases of amputation where primary adhesion of the skin flaps has occurred, and the surgeon has congratulated himself on the easy termination of the case, the patient has suddenly become the subject of constitutional disturbance, and the formation of pus deeply seated in the stump has revealed itself near to the bone or along the line of the sheaths of the tendons. It is to avert all this, or at least to attempt to do so, that we advocate those principles of antisepticity which we are anxious to see more generally adopted.

When antisepticity is so employed it may, indeed, be said to be prophylactic, or essentially preservative in its nature, and although it may fail in its totality, it will be partially beneficial. Where some large lacerated wound has been made, or where a large surface of the body has been exposed and the deeper tissues injured, such cases as these if left exposed, without the interposition of protective measures against putrefaction, will, about the third to the tenth day, after the first shock of injury has passed off, take on morbid action, irritative fever sets in, and the patient, who, perhaps, up to that time has appeared to be doing well, suddenly becomes the subject of constitutional disturbance, and life is often jeopardised or the vital powers seriously reduced. These unfavorable changes seem to come on just at that particular period when the processes of repair, otherwise passing on so quietly and successfully, are interrupted by the development of the products of putrefaction, and the consequent excitement which they create as constitutional irritants. In such a case, if antisepticity has been secured, if the excreta from the surface do not putrefy, or do not produce that amount of putrefaction which is attended by a fœtid odour and pungent smell, there may yet be chemical changes in the excretions enough to make them act injuriously on the surface, and yet not enough to be recognisable by mere superficial observation; and assuming these conditions to exist, there will still be this great difference in the two cases,—in the one constitutional disturbance would occur, in the other the greatest calmness and quiet in the system would prevail; the pulse does not rise in any great degree, the temperature if exalted quickly recovers its normal point, the skin does not act inordinately, the patient is not disturbed by sudden pain or anxious distress, and it is quite clear that either from the direct restorative influence of the antiseptic used, or negatively, by the absence of a source of local irritation, we are tiding the patient over that critical period of repair in which are to be determined the future changes we shall have to contend with in the progress of the case. It is either that the inflammatory changes requisite for repair are held back at the stage of fibrinous deposit, and not allowed to pass on to that of suppuration, or else it is that the changes are going on so slowly and so quietly as to be utterly inoffensive, and, in either case, we approach a favorable termination without that disturbance to the whole system which is so formidable in its effects. But there are yet two other points to be thought of in the treatment of recent wounds, on which those who have practised antisepticity in surgery can bear good testimony; the first is this, that where the wound has been caused by some laceration or severe contusion, or where from constitutional cause we dread the loss of substance by sloughing of the edges of the wound, this will be far less likely to occur under the antiseptic method of treatment than if the excretions of the wound were allowed to undergo change and themselves excite further mischief. And again, inasmuch as these changes will be held back below the suppurative stage, we are saved in the management of large wounds from that inordinate amount of secretion of pus which is so wearisome to the patient, and which interferes so much with his general comfort and often undermines his strength. Among other negative good effects of the antiseptic treatment of recent wounds, it may be mentioned that the sloughing process and the death of tissue being averted in the ligature of arteries, the chances of secondary hæmorrhage are greatly diminished, and the prospect of recovery made much more certain. Thus, as it has been observed, there are three classes of cases in which the antiseptic treatment of recent wounds is especially beneficial; viz., in the management of wounds made in opening large abscesses, in the wounds which occur in the ligature of arteries, and in those which accompany compound fractures; while the class of wounds in which, perhaps, the greatest difficulty arises are those of amputations, because, as will be seen afterwards, it is so difficult in these cases to carry out with complete efficiency all the details of antisepticity. But the other point has reference to the amount of pus secreted in any given case, and the importance which we shall attach to this will depend upon the notions we may entertain as to the true value of pus when excreted in the healing process. If pus is to be regarded as in any way itself of service, then by all means let us seek for suppuration; but the question ever returns, "*Cui bono pus?*" Tell me the value of pus, and I will seek to secure its formation. But, assuming it to be useless and injurious, why not direct our efforts to prevent its advent, for when once the vessels of any part have taken upon themselves the secretion of pus it is most difficult, if not impossible, to control their action and to stop its further production.

It may be here observed that, since in the putrefaction of the excretions of wounds sulphuretted hydrogen is frequently evolved, it is extremely desirable to detect it at as early a stage as possible. Among the many advantages to be attained by the use of the oiled-silk protective of Professor Lister, none is greater than the test which it furnishes of the actual state of the excretions of a wound by observing how far the oiled silk placed on the surface of the wound has undergone change of colour or become stained with a dark brown or black tint by sulphuretted hydrogen acting upon the lead in the boiled linseed oil with which this silk has been prepared. Whenever it is removed from the surface of a recent wound colourless or as nearly so as possible, we are certain that no very serious putrefactive change is going on. Yet I would particularly remark further, that from observations I have made this is not an absolutely crucial test as to the state of the excretions, inasmuch as it is highly probable that irritating compounds are formed under these circumstances before the production of sulphuretted hydrogen. We get a similar result where we employ on the surface of a wound any preparation of lead, for, if in solution as a lotion to the surface, it will quickly show by change of colour how far putrefaction has advanced to the stage of gaseous effusion.

Thus, to sum up, it may be said that in the management of recent wounds the chief objects obtainable by strict adherence to the principles of antisepticity, no matter how brought about, are these,—an absence of constitutional disturbance, the protection of the surface from loss of substance by sloughing or ulceration, and the saving of strength by the non-secretion of pus or its formation in harmless quantities. These conditions being secured there must be greater hope in every case, and a better chance for the effusion of coagulable lymph, whereby the adhesive and reparative processes are to be accomplished. But the influence of antisepticity in healing wounds is rather different from that observed in recent wounds. As soon as the first stages of repair have passed over, and it is evident that nature is trying to fill up some cavity which has been laid open, or to unite again tissues which have been severed, and to do this without the secretion of pus, simply by the effusion of organisable lymph, and as soon also as the surface has begun to gather in from all sides towards the centre, and the earliest formation of skin is recognisable in the thin blue line which surrounds the sore, it is then that we are entering on the stage of cicatrisation, and we may be said to be dealing with a "healing wound" in the place of a recent wound.

Now, it is in "healing wounds," as in wounds in which the reparative changes have passed through the phase of simple adhesion to the filling up of tissues, and in which the period is reached at which cicatrisation or skinning is to be effected, that the antiseptic method will often seem to be at fault, if the one great element of time alone be taken into account. Many wounds which have gone on well and even rapidly in their earlier stages now seem to flag and halt, in the closing scenes, as if from languor or want of power in the healing processes. The exact cause of this is not hard to find if we adopt the theory for the use of antiseptics which I have before propounded, namely, that their great if not their only use is to save the excretions of wounds from putrefactive change, by which the power of auto-inoculation or self-poisoning of the healing surfaces is neutralised, and the action from being destructive is rendered simply reparative. This very tendency to keep down inflammation and rapid cell-growth which acts so well in the early stages of repair is a cause of delay and difficulty later on. Diminished vascularity, and possibly diminished nerve power, retard nutrition, and the processes though sure are slow. In the formation of cicatrices of wounds so treated, if this plan be not deviated from until the very last—until, in fact, the new skin is perfectly formed, while extra time is occupied in the process, there is one great advantage derived from it, namely, that there is less deposition of fibrine in the cicatrix; it is in some way less unyielding in its nature, and the subsequent scar is more elastic, more pliable, and less different from the skin tissue immediately around it than if healed more rapidly and by a process more highly inflammatory. This I have repeatedly noticed, and I am sure others must also have observed the same. The fibrine being slowly deposited in the cicatrix it has subsequently a less tendency to contract, or as the late Dr. Addison used to say, to "crystallise" in the part, and these cicatrices are not followed by the same deformity and by those terrible results from slow contraction of tissue which we witness after severe burns, lacerations, &c. In the filling up of wounds by what is called the process of granulation a very erroneous opinion has long existed, viz. that one of the necessary conditions or properties of granulations is to secrete pus. Now the phenomena constantly exhibited in wounds treated upon antiseptic principles afford abundant example of the fact that considerable loss of tissue may be filled up or repaired by granulations without any secretion of pus, the granulations slowly advancing from day to day covered only by organisable lymph. It is near the end of the treatment of a healing wound, when cicatrisation is about to be completed, that it is often of great importance to decide whether or not the plan previously adopted shall or shall not be persevered in. Certainly where time is not "an element in the contract" it is best to allow a wound to heal entirely upon the same principle as that upon which it was treated from the commencement, but in hospital practice (and occasionally perhaps in private practice), where we desire to complete the cure as speedily as possible, we are compelled to change our plan, and allow the inflammation to run on a little further than we otherwise should have done, so that the changes may be brought about with greater rapidity even at the risk of exciting excretion of pus where only fibrine had previously been formed.

In making these remarks I am quite aware that no tissue in the body grows again more slowly than true skin, if, indeed, it can be said that in the cicatrices of wounds true skin is ever reproduced, and even in the whitened tissue which marks the seat of an old wound, perfect skin is never deposited, but only such material as will serve the purpose of a covering to the part devoid of those beautiful arrangements of secreting structure which are present in true skin. So it is probable that one cause of the delay in the final cicatrisation of a wound may be due to the very slow way in which skin is formed as compared with other tissues, yet, as I have said, the resulting cicatrix, being much more natural, is a consequence not to be lightly valued. Nevertheless we must admit that there are some circumstances which may induce us, while advocating the use of antisepticity in recent wounds, to permit some departure from detail in the management of healing wounds.

We have now to consider how the principles of antisepticity can be best applied, and applied in such a way as to occupy the least time, and be least likely to be accidentally departed from or infringed upon, and how far in our treatment of wounds by adopting a uniformity of plan we may secure a uniformity of result. In doing this, seeing that the principles of antisepticity as now applied are far more minutely carried out than has ever before been attempted, and that the subject has received its chief origin and continued impetus from the untiring labours of Professor Lister, it will be well to study some of the methods which he has adopted, and to see how, from time to time, they have been altered in detail but not in principle, and rendered less and less complex. I think it must be taken as a first principle that, whatever be the character of the putrefactive changes in the excreta of wounds, they certainly come from "something in the air." Whatever that may be, whether according to a chemical or a biological action, I leave others to determine; but taking the fact as it is, it will be necessary to exclude the air, or that "something" of its contents on which putrefaction depends. It is not the air, I say, but it is that *tertium quid* within it which we seek to neutralise or to get rid of, and inasmuch as practically, and with perfect accuracy, it is not possible absolutely to prevent air getting access to wounds, it is evident that the only chance we have is to alter the condition of the atmosphere which will surround their surfaces. This can only be done by using some material or agent which diffuses itself rapidly through the atmosphere; and thus it is a primary condition of competency in any antiseptic that it shall possess some degree of diffusibility or volatility, whereby its influence will extend some distance beyond the actual situation of the wound.

It would be impossible to enumerate all the kinds of antiseptics which even in recent years have been suggested; and in considering these different forms and the relative merits of each, it is difficult to come to a positive conclusion, inasmuch as in this, as in every other department of medicine, we can only draw our comparisons very imperfectly, for we can never go on *repeating* our experiments under circumstances precisely similar. If, for example, we take cases of amputation, it may be cases of amputation of the forearm in two persons of equal age, the necessity for amputation may have arisen from different injuries in each, although at an equal interval of time after the receipt of the injury. It will be seen in practice, that it is difficult to keep up an exact parallelism between any two cases at every stage of the treatment; the temperaments may vary; and in one of the same constitution there may be greater irritability of the skin as well as greater intolerance of the antiseptic than in the other. In one case there may be some accidental oozing of blood or even some secondary bleeding which may resist, suspend, or interrupt all our plans; or some of the dressings, either at the commencement or subsequently may become so far disarranged, that air is admitted to the surface, and all our previous efforts to avoid this are destroyed; and, running through and beyond all these occurrences, there may still exist in some cases a tendency to low reparative power which no plan of local treatment can correct. Recorded comparisons as to different treatment derived from statistics will serve us little unless we deal with "quantities of the same denomination," as arithmeticians say; therefore it is that I am unable to give any perfectly satisfactory statistics, or to verify my assertion that the antiseptic treatment is pre-eminently favorable in preventing the secretion of pus in surgical cases, where the healing of wounds is to be sought for, because I cannot bring forward at one and the same time cases precisely similar in all particulars, but yet conducted under different plans of treatment. I have worked almost exclusively with carbolic acid, but I would not say that carbolic acid is the only antiseptic which can be so used, nor would I say that I may not myself some day adopt some other. Camphor is a substance which has much to recommend it for the same object; it is slowly volatilisable at a common temperature, it controls putrefaction, and it does not irritate the surface of the skin if the vapour which it exhales be allowed to diffuse itself gradually, that is, if it is not covered in too much and used in a too concentrated form.

Chloralum, also, is a valuable antiseptic, but except by the vapour of free hydrochloric acid or chlorine itself, which it evolves, it can do little beyond the actual points of contact, and although it has the property of destroying odour to a great degree, especially in malignant ulcers, it does not last long enough, and requires to be too frequently replaced, to fulfil all the conditions we seek for; and, like all irritating vapours pent up too closely, it affects injuriously the surrounding healthy surfaces. The permanganate of potash, the salts of zinc, and the astringent solutions of *hæmatoxylum* and tannin, all help to bring about the same result and by processes not essentially different. It would seem, however, that so long as the antiseptic employed, no matter what it is, prevents putrefaction, the weaker the solution used the better. That a very small quantity of an antiseptic will check putrefaction in its early stage, though when putrefactive changes have long continued it will seem to be inefficacious, is well shown in the changes incident to fermentation and the formation of some of the lower forms of vegetable life, as in the production of mould, the *mycelium* of microscopists, in vegetable infusions. It is well known that a solution of gall nuts with iron, as in common ink, will very quickly undergo a fermentative change with the growth of mould upon its surface unless there be mixed with the solution some special substance to prevent it. Now, in an ounce of common ink, in which when alone such a change would take place, so small a quantity of the oil of cloves as is found in one clove will protect the whole for weeks and months, and if we assume that this is at the rate of less than one drop of oil in an ounce of ink where there are 480 such drops, it will be clear what a small proportion of the preservative produces the required result. Carrying out this principle, it is an interesting feature to be noted in the most recent methods of producing antisepticity that the solutions now employed are of far less strength than those which were at first used. Where, *e.g.*, in the early stages of the history of carbolic acid, we made use of a fifth, an eighth, or a tenth part, we now rarely make our solutions stronger than a fortieth, a sixtieth, or even a hundredth part. Surely this seems to point to the fact that influences brought to bear in a right direction act more by skill than force, and in this as in the use of medicines generally, whereas it was the practice years gone by to employ our drugs in large doses, forgetting that when so used they were often far beyond their needs, it is now found that smaller doses judiciously and cautiously applied will bring about more successful and lasting results. With the many methods, almost all suggested by the incessant labours of Professor Lister, we have at last arrived at a plan which if not in itself complete shows positively that the antiseptic method is well adapted to the earlier treatment of wounds before the germs of putrefaction (whatever they may be) have planted themselves upon the part, and so the difficulties have been diminished a thousandfold. The latest and as yet the most simply applied method is to use on the surface of the wounded part what Professor Lister has called his carbolised *muslin dressing* in itself a valuable modification of the antiseptic cere-cloth for dressing wounds which I described at our meeting at Leeds in 1869, but with these two important additions, that by the use of resin in addition to parafine the carbolic acid is in some way held more firmly in the composition, so that when the muslin is saturated with it the carbolic vapour passes off much less rapidly and produces less irritation, and at the same time lasts longer than it otherwise would do, by the stream of antiseptic influence being slow and long continued. The other advantage it has over the cere-cloth is that the carbolised muslin dressing is made of a porous fabric—thin muslin; thus allowing some egress for the perspiration and the watery elements in the excretions of the wound which diminishes the progress of putrefaction, the muslin also being capable of adapting itself to inequalities in the surface by being pliable and slightly adhesive. The plan, therefore, now adopted is to take care to cover the surface of the wound with the vapour of carbolic acid in the form of a watery solution either by a spray producer, by a syringe, or by an irrigator, so as to wash away any impure matter which may have fallen upon the surface by accidental exposure of the wound, to place the carbolised muslin over the part in several layers without interposing any oiled silk for the first twenty-four or thirty-six hours the fluid excretions will pass into the pores of the dressing and there be protected from putrefactive change by antiseptic influence. It is very curious and important to note, in removing the so carbolised muslin dressings, that where they are stained by the discharges, which will be partially dried at certain spots, it is the outermost layers of muslin in which the most fœtor will be present, and not in those nearest to the wound, proving that the changes of putrefaction have travelled in a centripetal course from surface, or air-contact, to centre until, if neglected, the whole mass would be tainted. On the first dressing being removed about the end of the first or second day it is necessary only to renew it on the second instead of the first day, so that at the end of the first week the number of dressings will be found to be greatly diminished. The plan used to be, when we employed lac plaster (which did not absorb the secretions, but allowed them to escape beneath its edges), to reapply it every day for the first five days; but in the dressings now used a change is only made at the end of thirty-six hours, then each forty-eight hours for three or four times, and afterwards at longer intervals. This fact alone will show that in carrying out the antiseptic system practically many of the objections on the score of time which used to be made against it are now got rid of, and the whole process is greatly simplified. For so soon as we admit that this principle has been established, that the avoidance of putrefaction in the excretions of wounds in the early stages is the thing most required and most to be looked to, it will be evident that the principles enunciated by Professor Lister from his first experiments will all come true, although for their successful elaboration a lifetime of labour may hardly yet suffice.

*Postscript.*—The allusion on page 3 to the irrigation of wounds by cold water, as illustrating another method of carrying out the principles of antisepticity, has received a remarkable confirmation by the experience of Dr. Tuson, of the Bengal Army, from whom I have been favoured with the following communication, which he forwarded to me for publication after he had read this paper, and witnessed the system of dressing wounds, which I now practise in our hospital. He says, "I have read with much interest an article in the 'Manchester Medical and Surgical Reports,' written by Mr. Lund, Surgeon to the Manchester Infirmary, on "Antisepticity in Surgery," and as the subject is of considerable importance, I think it only due to this eminent surgeon to endorse his views by my own experience and practice during several campaigns on the north-west frontier of India, and the memorable mutiny in 1857. Mr. Lund most justly remarks that the antiseptic treatment of wounds does not merely imply the exclusive use of carbolic acid, but of other antiseptics, to obviate the putrefactive changes that occur in the process of granulation and cicatrization.

"This appears to be the true rationale of the present method of treating wounds by antiseptic measures, thereby preventing pyæmia, and I believe, in a great measure, osteo-myelitis, by keeping them free from suppuration.

"Although the antiseptic treatment was not recognised by the profession at the time of the Indian Mutiny, and subsequently in 1860, when I was on active service in the Mahsood Wuzeerie campaign, I was induced to adopt the treatment of wounds by irrigation with cold water, knowing that in India putrescence comes on so quickly, that it was of paramount importance to preserve them from such a deleterious result.

"The climate being favorable, and the water not too cold to lower the temperature and vitality of the injured parts, I used extensively water irrigation to the wounded men under my care, and I can safely say that the result was more favorable than I could have anticipated.

"The wounds inflicted on our men during the Wuzeerie expedition were of a frightful nature, caused by long triangular knives, or rather swords. The magnitude of the wounds then under treatment, may be imagined by a description of one wounded man, the only surviving one out of a picquet of our regiment—The Guides—engaged in that action.

"This poor fellow I found on the field, and almost felt his case was hopeless. He had four incised wounds of the head, two of which penetrated to the brain; three or four extensive wounds on the back, dividing the muscles of that region; a wound of enormous size over the right hip-joint, dividing all the muscles, and so deep as to sever the neck of the femur. I can have no doubt that the neck of the femur was cut through, as the limb was perfectly mobile, and the foot everted. The long straight splint was used in the same manner as for fracture of neck of the femur. There was a wound over the knee-joint, penetrating the synovial membrane, besides several other wounds on the calf, dividing the gastrocnemius and soleus muscles.

"These extensive injuries were all treated by cold water, with the exception of those on the back and calf, which were difficult to reach on account of their situation, and these gave me more trouble than any of the others. The man recovered most rapidly. I have related this case as an illustration of the kind of wounds inflicted during that campaign, and in the whole course of my service I have never seen such extensive injuries.

"The system of cold water being kept constantly running on the wounds was carried out in most, if not all, of the cases—about 300 in number; and the rapid recoveries that were made quite surprised me.

"I had no cases of pyæmia or osteo-myelitis after amputation, and the patients recovered generally without any untoward symptoms.

"The result of these cases proves, I apprehend, that keeping the wounds free from pus, and disintegrated tissue, favoured their rapid healing, and is on the same principle as antiseptic surgery, only doubtless not so efficacious or satisfactory.

"JOHN EDWARD TUSON, M.D., F.R.C.S.,
" *Surgeon, Bengal Army.*

"NOVEMBER 24TH, 1871."

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